wave numbers are directly proportional to the energy of photon.

Worksheet #6

1) **Looking at the infrared spectrum in Figure 6.3, what are the units of the x and y axes? What is their significance?**

$E_{photon} = h\nu = \frac{hc}{\lambda} = hc\tilde{\nu}$

x-axis: Units: cm^{-1} $\quad \tilde{\nu} = \frac{1}{\lambda}$

Wavenumbers ($\tilde{\nu}$)

y-axis: % Transmittance $\Rightarrow$ $\%T = \frac{I}{I_o} \times 100$

(I: intensity of light that passes sample (not absorbed); I_o: intensity of light before it passes sample.)

2) **Calculate the energy of the radiation at both ends of the spectrum (in kJ/mol).**

$600\ cm^{-1} \Rightarrow E = (6.626\times10^{-34}\ J\cdot s)(3.00\times10^{10}\ cm/s)(600\ cm^{-1}) = 1.19\times10^{-20}\ J/photon \left(\frac{1\ kJ}{1000\ J}\right)\left(6.022\times10^{23}\ \frac{photons}{mol}\right)$

$= 7.18\ kJ/mol$

$4000\ cm^{-1} \Rightarrow E = (6.626\times10^{-34}\ J\cdot s)(3.00\times10^{10}\ cm/s)(4000\ cm^{-1}) = 7.95\times10^{-20}\ J/photon \left(\frac{1\ kJ}{1000\ J}\right)\left(6.022\times10^{23}\ \frac{photons}{mol}\right)$

$= 47.9\ kJ/mol$

3) **Does the energy in the spectrum decrease or increase from left to right?**

Energy decreases from left to right

4) **Looking at Table 6.1, is this energy enough to break a bond?**

No, it's not enough to break a bond.